2011 American Geophysical Union Fall Meeting

San Francisco, California

December 5-9, 2011

Low Frequency Turbulence as the Source of High Frequency Waves in Multi-Component Space Plasmas

George V. Khazanov, Emmanuel N. Krivorutsky, and Vadim M. Uritsky

Space plasmas support a wide variety of waves, and wave-particle interactions as well as wave-wave interactions are of crucial importance to magnetospheric and ionospheric plasma behavior. High frequency wave turbulence generation by the low frequency (LF) turbulence is restricted by two interconnected requirements: the turbulence should be strong enough and/or the coherent wave trains should have the appropriate length. These requirements are strongly relaxed in the multi-component plasmas, due to the heavy ions large drift velocity in the field of LF wave. The excitation of lower hybrid waves (LHWs), in particular, is a widely discussed mechanism of interaction between plasma species in space and is one of the unresolved questions of magnetospheric multi-ion plasmas. It is demonstrated that large-amplitude Alfvén waves, in particular those associated with LF turbulence, may generate LHWs in the auroral zone and ring current region and in some cases (particularly in the inner magnetosphere) this serves as the Alfvén wave saturation mechanism. We also argue that the described scenario can play a vital role in various parts of the outer magnetosphere featuring strong LF turbulence accompanied by LHW activity. Using the data from THEMIS spacecraft, we validate the conditions for such cross-scale coupling in the near-Earth "flow-braking" magnetotail region during the passage of sharp injection / dipolarization fronts, as well as in the turbulent outflow region of the midtail reconnection site.